Technical Report

ISO/TR 23509-2

Bevel and hypoid gear geometry —
Part 2: Sample calculations

Géométrie des engrenages coniques et hypoïdes —
Partie 2: Exemples de calcul

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Contents

Page

Foreword ..... **iv**

Introduction ..... **v**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **1**

4 Symbols and abbreviated terms **1**

5 Application **5**

Annex A (informative) **Sample 1: Calculation of geometry for a spiral bevel gear pair without hypoid offset according to ISO 23509-1:2025 , Method 0** **8**

Annex B (informative) **Sample 2: Rating of a hypoid gear set according to ISO 23509-1:2025, Method 1** **23**

Annex C (informative) **Sample 3: Rating of a hypoid gear set according to ISO 23509-1:2025, Method 2** **43**

Annex D (informative) **Sample 4: Rating of a hypoid gear set according to ISO 23509-1:2025 , Method 3** **65**

Annex E (informative) **Sample 5: Rating of a hypoid gear set with angle modification and 60° shaft angle according to ISO 23509-1:2025, Method 3** **84**

Annex F (informative) **Sample 6: Calculation of geometry for a straight bevel gear pair without hypoid offset according to ISO 23509-1:2025, Method 0** **103**

Bibliography **117**

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Foreword

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This document was prepared by Technical Committee ISO/TC 60, *Gears*, Subcommittee SC 2, *Gear capacity calculation*.

A list of all parts in the ISO 23509 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

For many decades, information on bevel, and especially hypoid, gear geometry has been developed and published by the gear machine manufacturers. It is clear that the specific formulae for their respective geometries were developed for the mechanical generation methods of their particular machines and tools. In many cases, these formulae can not be used in general for all bevel gear types. This situation changed with the introduction of universal, multi-axis, computerized numerical control (CNC)-machines, which in principle are able to produce nearly all types of gearing. The manufacturers were, therefore, asked to provide CNC programs for the geometries of different bevel gear generation methods on their machines.

This document integrates straight bevel gears and the three major design generation methods for spiral bevel gears into one complete set of formulae. In only a few places, specific formulae for each method will be applied. The structure of the formulae is such that they can be programmed directly, allowing the user to compare the different designs.

The formulae of the three methods are developed for the general case of hypoid gears and to calculate the specific case of spiral bevel gears by entering zero for the hypoid offset. Additionally, the geometries correspond such that each gear set consists of a generated or non-generated wheel without offset and a pinion which is generated and provided with the toral hypoid offset.

This document was prepared with sample calculations for different bevel gear designs. They are intended for users of the ISO 23509 series to follow a whole calculation procedure formula by formula. Practical experience has shown that this way, to get into a complex subject, is very helpful.

On the other hand, this document is not intended for use by the average engineer. Rather, it is aimed at the well-versed engineer capable of selecting reasonable values for the parameters and factors in these formulae based on knowledge of similar designs and on awareness of the effects behind these formulae.

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Bevel and hypoid gear geometry —

Part 2:
Sample calculations

1 Scope

This document provides sample calculations for different bevel gear designs, how the geometry is numerically determined according to the methods and formulae of ISO 23509-1:2025 .

The term “bevel gear” is used to mean straight, helical (skew), spiral bevel, zerol and hypoid gear designs. Where this document pertains to one or more, but not all, the specific forms are identified.

The manufacturing process of forming the desired tooth form is not intended to imply any specific process, but rather to be general in nature and applicable to all methods of manufacture.

The geometry for the calculation of factors used in bevel gear rating, such as ISO 10300-1 [1], ISO 10300-2 [2], and ISO 10300-3 [3], is also included.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1122-1, *Vocabulary of gear terms — Part 1: Definitions related to geometry*

ISO 23509-1:2025, *Bevel and hypoid gear geometry — Part 1: Basic methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1122-1, ISO 23509-1:2025, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and units given in Table 1 and Table 2 apply.

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